

Nuclear energy — Nuclear fuel technology — Scaling factor method to determine the radioactivity of low- and intermediate-level radioactive waste packages generated at nuclear power plants

ICS 27.120.30

National foreword

This British Standard was published by BSI. It is the UK implementation of ISO 21238:2007.

The UK participation in its preparation was entrusted to Technical Committee NCE/9, Nuclear fuel cycle technology.

A list of organizations represented on this committee can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2007

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ISBN 978 0 580 50829 5

Amendments issued since publication

Amd. No.	Date	Comments

INTERNATIONAL STANDARD

ISO
21238

First edition
2007-04-15

Nuclear energy — Nuclear fuel technology — Scaling factor method to determine the radioactivity of low- and intermediate-level radioactive waste packages generated at nuclear power plants

*Énergie nucléaire — Technologie du combustible nucléaire — Méthode
des ratios pour déterminer la radioactivité des colis de déchets de faible
et moyenne activité produits par les centrales nucléaires*



Reference number
ISO 21238:2007(E)



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Foreword

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ISO 21238 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 5, *Nuclear fuel technology*.

Introduction

Burial disposal of low- and intermediate-level radioactive waste has been practiced in several countries. Before disposal, the radioactivity of specific nuclides in waste packages have to be declared in accordance with limits and criteria derived from safety assessment of the disposal facility. Some of these nuclides are difficult to measure from the outside of the waste packages, because they are beta or alpha emitting nuclides.

There are a number of activity determination methods. The scaling-factor method is widely applied in order to evaluate these difficult-to-measure nuclides. The scaling-factor method is based on a correlation between easily measurable gamma emitting nuclides and difficult-to-measure nuclides. This International Standard presents guidelines on the empirical scaling-factor method for evaluating the radioactivity of nuclear power plant's low and intermediate level waste.

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1 Scope

This International Standard gives guidelines for the common basic methodology of empirically determining scaling factors to evaluate the radioactivity of difficult-to-measure nuclides in low- and intermediate-level radioactive waste packages.

This International Standard gives common guidelines for the scaling factors used in the characterization of contaminated wastes produced in nuclear power plants with water-cooled reactor. This International Standard is also relevant to other reactor types, such as gas-cooled reactors. Methodologies for determining scaling factors based on theoretical considerations (i.e. not based on experimental measurement) are not covered by this International Standard.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

difficult-to-measure nuclide

nuclide whose radioactivity is difficult to measure directly from the outside of the waste packages by non-destructive assay means

EXAMPLE Alpha emitting nuclides, beta emitting nuclides, and characteristic X-ray emitting nuclides.

2.2

key nuclide

gamma emitting nuclide whose radioactivity is correlated with that of difficult-to-measure nuclides and can be readily measured directly by non-destructive assay means

NOTE Also called “easy-to-measure nuclide” or “marker nuclide”.

EXAMPLE ^{60}Co and/or ^{137}Cs .

2.3

scaling factor

factor or parameter derived from mathematical relationship used in calculating the radioactivity of difficult-to-measure nuclide from that of key nuclide determined from sampling and analysis data

2.4

waste package

product of conditioning that includes the waste form and any container(s) and internal barriers (e.g. absorbing materials and liner), as prepared for handling, transportation, storage and/or disposal

NOTE Adapted from IAEA *Radioactive Waste Management Glossary*. 2003 Edition^[1].

2.5
representative sample
sample taken from a process of the material in that process or that quantity of material which is considered to possess the average characteristics of the material

NOTE 1 Adapted from ISO 921:1997^[2].

NOTE 2 Samples of waste are used to determine the scaling-factor parameters for the target waste stream. A representative sample is meant to closely resemble the characteristic nuclide content and activity proportions of the target waste stream.

2.6
composite sample
mixture of samples from different containers such that the mass ratio of the samples is equal to the ratio of the material masses contained in the containers

NOTE Adapted from ISO 921:1997^[2].

EXAMPLE Series of samples taken over a given period of time and weighted by collection rate; or a combined sample consisting of a series of discrete samples taken over a given period of time and mixed according to a specified weighting factor, such as stream flow or collection rate.

2.7
corrosion product nuclide
nuclide produced by activation of corrosion products temporarily deposited on in-core surfaces

EXAMPLE ^{60}Co , ^{63}Ni .

2.8
fission product nuclide
nuclide produced either by fission or by the subsequent radioactive decay of nuclides thus formed

NOTE Adapted from ISO 921:1997^[2].

EXAMPLE ^{137}Cs , ^{90}Sr .

2.9
alpha emitting nuclide
nuclide emitting an alpha particle when it decays

EXAMPLE Most actinides and transuranic nuclides.

2.10
transuranic nuclide
nuclide with atomic numbers above 92

2.11
dry active waste
solid waste generated in various waste streams in a nuclear power plant, including protective clothing, replaced equipment, parts, plastics, polyvinyl chloride sheets, and high efficiency particulate air filters removed during plant operation and maintenance

2.12
homogeneous waste
radioactive waste that shows an essentially uniform distribution of activity and physical contents

EXAMPLE Flowable wastes such as concentrates, solidified liquids and spent resins, in which the radioactivity may reasonably be assumed to be uniformly distributed over the volume or flowable wastes uniformly mixed with a solid matrix.

2.13
heterogeneous waste
radioactive waste that does not meet the definition of homogeneous waste, including solid components and mixtures of solid components, such as dry active waste and cartridge filters